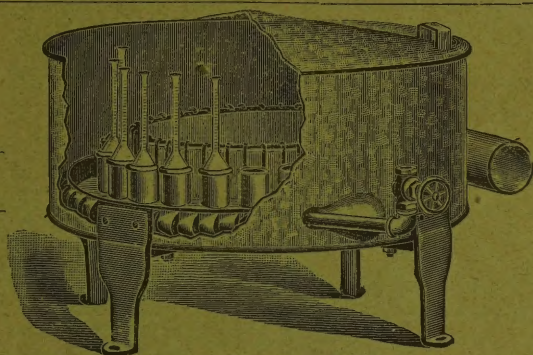


— BABCOCKING —

— WITH THE —

V. F. M. CO.'S BABCOCK TESTER.



ACCURACY.

EFFICIENCY.

SIMPLICITY.

For its "Excellence of Design, Ease of Operation and Practical Utility," the V. F. M. Babcock Tester was awarded Medal and Diploma of Highest Merit at the World's Columbian Exposition, Chicago, 1893.

VERMONT FARM MACHINE CO..

BELLOWS FALLS, VT.

No. 102.

*C. H. Benson,
Groton City, N. H.*

We manufacture and sell everything that is used in the

DAIRY OR CREAMERY

READ THE LIST AND WRITE US FOR WHAT YOU WANT.

Cooley Creamers for Dairy and Cream Gathering

Dairy Sizes, Centrifugal Cream Separators,

Power Sizes, Centrifugal Cream Separators

Engines.
Boilers.
Davis Swing Churns.
Barrel Churns.
Square Box Churns.
Eureka Butter Workers.
Skinner Butter Workers.
Philadelphia Imp'd Butter Workers.
Power Butter Workers.
Cream Vats.
Receiving Milk Vats.
Cheese Vats.
Self-gauging Butter Printers.
Print Butter Carriers.
Pike's Veneer Wrappers.
Round Butter Boxes.
City Milk Cans.
Dog Powers.
Milking Tubes.
Feed Cookers.
Calf Feeders.
Tub Fasteners.
Scrub Brushes.
Stencils.
Parchment Paper.
Test Tubes.
Graduates for Color.
Thermometers.
Butter Tryers.
Butter Color.
Milk Books.
Cream Ledgers.
Cream Gatherers' Books.
Milk Coolers.
Babcock Milk Testers.
Heater Vats.
Cheese Factory Cans.
Cream Transportation Cans.
Steam and Power Pumps.
Hoisting Crane Irons.
Cream Gatherers' Pails.

Weigh Cans.
Rubber Mops.
Conductor Heads.
Hair Sieves.
Cream Vat Strainers.
Churn Strainers.
Buttermilk Strainers.
Gable Milk Strainers.
Cream Cans and Agitators.
Dairy and Creamery Ladles.
Butter Spades.
Butter Bowls.
Butter Packers.
Milk Scales.
Dairy Scales.
Butter Scales.
Salt Scales.
Belting.
Hose.
Packing.
Milk Pumps.
Steam and Water Pipe.
Fittings for Iron Pipe.
Shafting.
Hangers.
Pulleys.

Sap Evaporators.
Iron Arches.
Sugaring-off Pans.
Sap Spouts.
Sap Buckets.
Sap Storage Tanks.
Sap Hauling Tanks.
Syrup Cans.
Sugar Moulds.
Sugar Thermometers.
Sap Heaters.

Water Heaters.

Fruit Dryers.

WHY we are the LEADERS in our various lines: BECAUSE we handle nothing but the very BEST.

The Dr. Babcock Milk Tester.

One of the most magnificent gifts to the people of this country is that of Dr. S. M. Babcock in giving to the public his simple, quick and accurate test for the determination of the amount of butter fat contained in whole milk, cream, skimmed milk, butter-milk or whey. A simple and accurate test of this sort is what scientists have been endeavoring to produce for a long time, and when Dr. Babcock discovered and perfected his method, and gave to the dairy public the benefit of his investigations, he conferred upon them a great blessing. The Babcock Test is so reliable that physicians use it and recommend it as valuable for testing certain liquids which contain the ingredients which the test is capable of measuring. An article read by Henry G. Pifford, A. M., M. D., before the New York Academy of Medicine, calls attention to the great value of the Babcock Tester for testing milk used in nursing, either that bought for the purpose, or the milk furnished by the mother. To show the value of this tester for private family use he says:

"I had been paying ten cents a quart for the milk furnished by a well-known purveyor. A competing milkman offered to furnish 'just as good' for seven cents. A few tests were enough to show that the ten-cent milk was the cheaper."

It will at once be seen how valuable this tester would be in large institutions like hospitals or sanitariums, where good milk is so necessary. Many other uses to which the Babcock tester can be put, and in which it will become of untold benefit, are yet to be discovered.

We say this gift of Dr. Babcock's was a magnificent one, because he could have protected his discovery by patents, as he had a perfect right to do, and it would have been a great pecuniary gain to himself if he had done it. But he would not yield to the pleading of his friends and co-workers to patent his invention, either for his own benefit or for the benefit of the Station with which he was connected. He persisted in his determination to give his discovery to the public without remuneration other than the consciousness of having greatly helped those in whom he is interested and for whose good he works. Yet for the very reason that he did not so protect it, in this generous gift there lies a serious danger, and we wish to sound the alarm so loudly that none need suffer. The need, and the completeness of the Babcock Tester to fill that need, has caused a great demand which has tempted incompetent and unreliable apparatus to be put upon the market. These cheap, inefficient testers do not do the work properly, a complete separation of the fat is not obtained, and the test, as a test, is a failure.

Therefore, in selecting an apparatus you should be very certain that you obtain one that is so constructed that it will carry out the Doctor's method perfectly to the end. It will be readily seen that it is worse than a mistake to purchase an apparatus because it is cheap, as such a machine will prove cheap indeed and will not give a satisfactory test. You will have invested your money and yet when you use your test you will know but little if any more in regard to the value of the liquid tested than you did before. The only conclusion can be that it is only safe to purchase your apparatus of a house that has a reputation at stake and that will furnish only such an apparatus as will successfully carry out Dr. Babcock's process to the end, if used according to the directions accompanying the machine. No house with a reputation at stake can afford to put on to the market a cheap, inefficient tester.

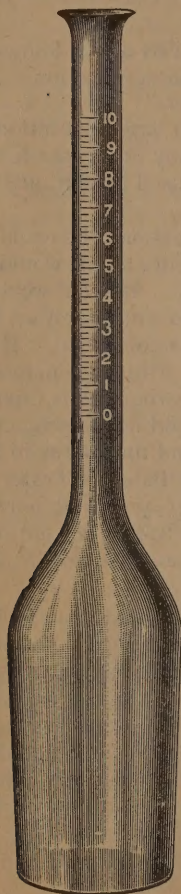
We have studied Dr. Babcock's method carefully, have sought his advice in reference to the construction of the machine and the directions for manipulating, and have used every effort to produce an apparatus in which to use his test that shall be worthy of

the test, and our own trials of our machines, as well as the reports from scientists and others who are expert in the use of the Babcock Test, assure us that we have succeeded to a remarkable degree.

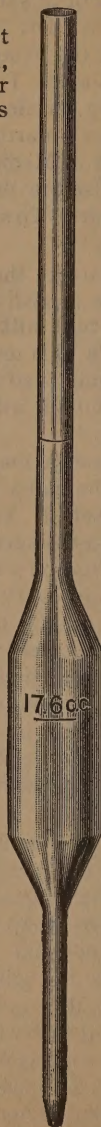
The speed given to the bottles in the machine, determined by the diameter of the circle in which these bottles revolve, is a very important factor in the manipulation of the apparatus to produce a perfect test. If the speed is too slow for the size of circle described by the bottles, the results will not be satisfactory. Therefore it is very necessary that the speed be kept up to what is required for the circles of different diameters. To enable this to be done without making the work too hard, the tester must be properly constructed. With crank machines the speed can be readily ascertained by counting the revolutions of the crank, and multiplying that by the number of revolutions of the bottle-head to one turn of the crank, so that the crank furnishes the best sort of a speed indicator. With our Steam Turbine Babcock Testers we furnish a special speed indicator if ordered.

The speed necessary for a perfect test to 1,200 revolutions of the bottle-head, tions being sufficient for the larger 20 inches, while 12-inch bottle-heads tions per minute.

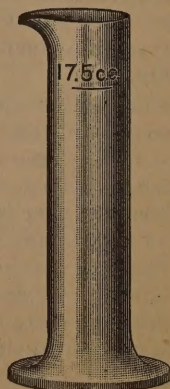
is given by the scientists as from 700 according to the diameter; 700 revolution-bottle-heads with a diameter of about should run at the rate of 1,200 revolutions



Babcock Milk Bottle.



Pipette for Milk.
(Pipette for Cream holds 18 c. c.)

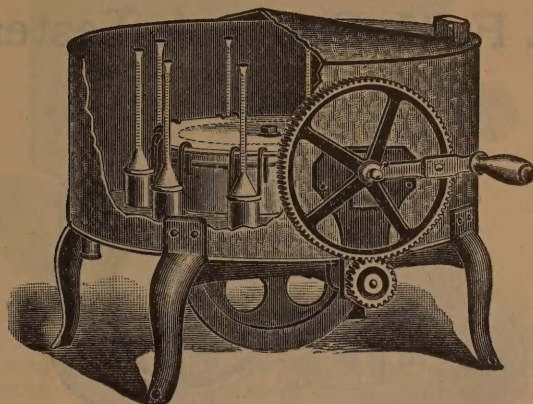


Acid Measure.

We guarantee our Babcock Glassware to be standard and capable of standing any test of its accuracy.

V. F. M. Babcock Tester.

STYLE A.



We present herewith an illustration of our Style **A**, V. F. M. Tester, which is so constructed that a very high speed is obtained with a small number of revolutions of the hand crank. With 40 turns of the crank the bottle-head reaches a speed of 1,120 revolutions per minute, and 60 turns of the crank gives 1,680 revolutions of the bottle-head per minute. This shows that the range of speed is such that even a careless hand with the machine can hardly fail to obtain a sufficient rate of speed to comply with what the scientists consider necessary for making a thorough and complete test; thus avoiding the very unsatisfactory results that have been obtained with many Testers of other make, not because of fault in the method, but because of the faulty construction of the apparatus.

40 turns per minute of the crank is ample to obtain the proper speed.

This very important qualification of ease in obtaining the required speed without too great a speed of the crank, together with the good workmanship and the convenience of the apparatus, combine to make our style **A** Babcock Tester the very best hand-operated machine on the market.

When in motion the bottles take a nearly horizontal position.

PRICE LIST.

4-bottle Tester, swinging pockets, with outfit.....	\$ 8.00
6 " " " "	9.00
8 " " " "	10.00
10 " " " "	12.00
12 " " " "	14.00
16 " " " "	18.00
20 " " " "	20.00
With galvanized iron castings, additional.....	1.00
All sizes fitted for belt power "	3 00

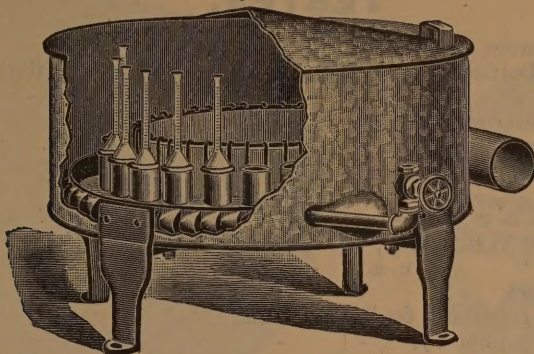
Outfit Consists of a full set of regular Babcock milk bottles, pipette, acid measure, acid sufficient for making 50 to 100 tests, and directions for manipulating. All testers are fitted out with the milk bottles unless different bottles are ordered.

For additional price for Cream or Composite Bottles, see price list of extras.

Glassware at Purchaser's risk of Breakage.

V. F. M. Steam Motor Babcock Tester.

STYLE D.



For creamery use, or for use in any place where steam is available, the Steam Turbine V. F. M. Babcock Tester is most assuredly *the* machine to use. When ready for the test, all that is necessary is to turn the hand wheel in the valve, and in rushes the steam, a very small quantity of which is sufficient to run the bottles at the required speed, with no exertion whatever on the part of the operator. At the same time, the steam keeps the tests hot, which is a valuable feature of the Steam Tester.

The bottles in revolving take a nearly horizontal position.

The exhaust can be piped out of doors.

Dr. Babcock considers a speed of 1,000 revolutions per minute the surest of producing perfect results, although he says a less speed will doubtless do the work, while, as will be seen, others think a less speed sufficient.

According to Bulletin No. 119 of the Connecticut Experiment Station, only 700 revolutions per minute are required for a Tester in which the bottles describe a circle twenty inches in diameter. In tests made with our 20-bottle 20-inch Tester, with all the bottles loaded the required speed was exceeded with only 15 pounds of steam, the bottles running at 754 revolutions per minute. With 20 pounds of steam, the speed was 908 revolutions; with 25 pounds, 1,016 revolutions, and with 30 pounds of steam, the bottles made 1,126 revolutions per minute. According to these figures, for a circle of $17\frac{1}{2}$ inches, 800 revolutions per minute is the speed required. In tests of our 12-bottle, $17\frac{1}{2}$ inch circle Steam Tester, with only 10 pounds of steam a speed of 970 revolutions per minute was attained; with 15 pounds, 1,020 revolutions; with 20 pounds, 1,162 revolutions; with 25 pounds, 1,203 revolutions, and with 30 pounds, 1,308 revolutions per minute. These trials show how easily our Steam Turbine Tester can be made to develop the necessary speed, and that a pressure at the Tester of 30 lbs. of dry steam should give sufficient speed to answer the requirements of the most critical. A glance at the above illustration will show that the construction is such that it can be speeded up with the least possible amount of steam. The bottle-head is supported by a steel shaft that revolves in a pocket which is constantly filled with oil, and this with the other details of construction, make it a most perfect running machine.

When so ordered, we supply a specially constructed speed indicator for use with this Tester, which is a very valuable addition, as it is very essential to know that the proper speed is being developed.

Price extra for Speed Indicator,	-	-	-	-	-	\$2 00.
Reverse Steam Jet, with valve,	-	-	-	-	-	.75.
Steam Gauge,	-	-	-	-	-	2.25.

PRICE LIST.

12-bottle Tester, Swinging Pockets, with outfit.....	\$18.00.
16 " " " " " "	22.00.
20 " " " " " "	24.00.
24 " " " " " "	27.00.
30 " " " " " "	32.00.
36 " " " " " "	36.00.
50 " " " " " "	48.00.
With galvanized castings, additional.....	1.00.

Outfit Consists of a full set of regular Babcock milk bottles, pipette, acid measure, acid sufficient for making 50 to 100 tests, and directions for manipulating. All Testers are fitted with milk bottles unless different bottles are ordered.

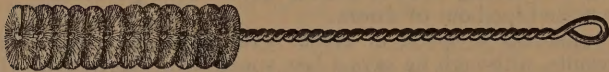
For additional price for Cream or Composite Bottles, see price list of extras.

PRICE LIST OF EXTRAS FOR THE BABCOCK
TESTER.

	Each.	Per Doz.
Babcock Milk Test Bottles, - - - - -	\$.30	\$3.00
Babcock Cream Test Bottles, (Conn. Bottle will be sent unless Bartlett is ordered,) - - - - -	.50	5.00
Babcock Skim and Buttermilk Bottles, - - - - -	.40	4.00
Babcock Composite Bottles, - - - - -	.40	4.00
Acid Measures for Babcock Test, - - - - -	.25	
Pipettes for Milk, - - - - -	.25	
Pipettes for Cream, 18 c. c., - - - - -	.25	
Pipettes for Composite Test, 5 c. c., - - - - -	.25	
“ “ “ 5.9 c. c., - - - - -	.25	
Syphon, with pinch cock - - - - -	1.50	
Spring Balance (Fig. 1, plate 1) 60 lbs. by 2 oz., - - - - -	6.00	
Sampling Tube (Fig. 3, plate 1), - - - - -	1.50	
Sampling Pail (Fig. 2, plate 1), - - - - -	2.00	

All Glassware at Purchaser's Risk of Breakage.

TEST BOTTLE BRUSHES.



Price, - - - - -	.10	1.00
------------------	-----	------

SULPHURIC ACID.

In quart bottle (with rubber stopper) for about 60 tests, - - -	.40
Per gallon, - - - - -	.75
By the carboy, 170 to 190 lbs., per lb., - - - - -	.02½

A charge of \$1.50 is made for the carboy, which amount will be credited, less transportation charges, upon the return of the carboy in good condition.

At Purchaser's Risk of Breakage.

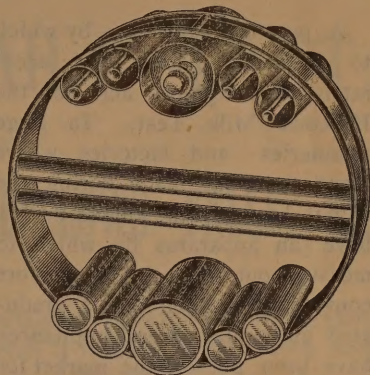
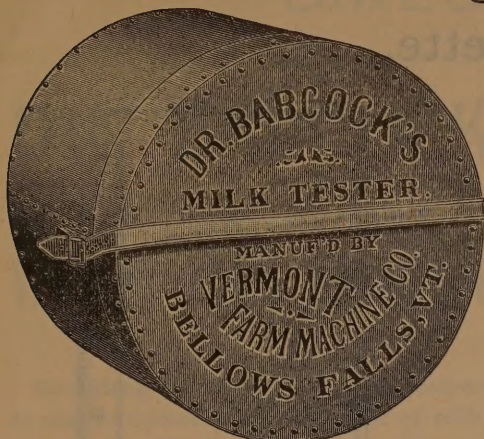
THIS BLANK IS PREPARED FOR USE IN CONNECTION WITH
DR. BABCOCK'S MILK TEST,

MANUFACTURED BY
VERMONT FARM MACHINE COMPANY, Bellows Falls, Vt.

MONTH.						
DATE.	Name of Patron or Name of Cow.	Pounds of Milk.	No. of Test Bottle.	Per Cent of Butterfat.	Butter Yield. Pounds.	

Price for tablet containing 50 sheets, - - - - - \$.25

Travelling Cases.



These Travelling Cases are light and strong, and are extremely neat and very convenient for the use of persons who have occasion to make tests in different places. Our style **B** Tester, is especially adapted for use in this manner. For carrying the bottles for testing, to hold the acid, etc., we furnish what we term a "Cartridge Belt," shown in the illustration above, which is stowed away inside the Tester for transportation, and the whole enclosed in the Travelling Case, making a compact and easily handled outfit.

Price extra (not including the Tester) for Traveling Outfit for eight-bottle Tester and smaller, consisting of Leatheroid Case and Cartridge Belt,\$6.50

For Prices of Testers, see Price List.

Greiner's Automatic Pipette.

DIRECTIONS.



Compress the rubber bulb sideways with thumb and two fingers of the right hand until the walls of bulb meet; then dip the end of the pipette into the milk about half an inch and let the bulb go by holding the pipette with the left hand only until the milk ceases entirely to flow. Lift out gently and empty the contents by pressing the rubber bulb. If the bulb is compressed properly, there will be but little overflow and from 12 to 20 samples can be taken, till it becomes necessary to detach the rubber bulb to empty the overflow. A like pipette can be used also for measuring the acid, which should be poured first into a graduate or wide glass and from there the exact quantity can be drawn by means of this pipette according to above directions. However, it will be advisable to change occasionally the rubber connection (a piece of black rubber tubing will answer very well) which keeps the pipette in the overflow bulb as the acid will corrode it in the course of time, but if the pipette is rinsed with cold water before putting it away, the connection will last a long time. It is also desirable to clean the milk pipette with warm water, after all the samples for the day have been taken.

This pipette is *guaranteed* to hold *exactly* 17.6 cc. for milk, and 17.5 cc. for acid.

After practicing above directions a few times with water, every one will be able to use this instrument with ease and will never return to the old way of drawing the milk by mouth into the pipette or pouring the acid into the measuring glass.

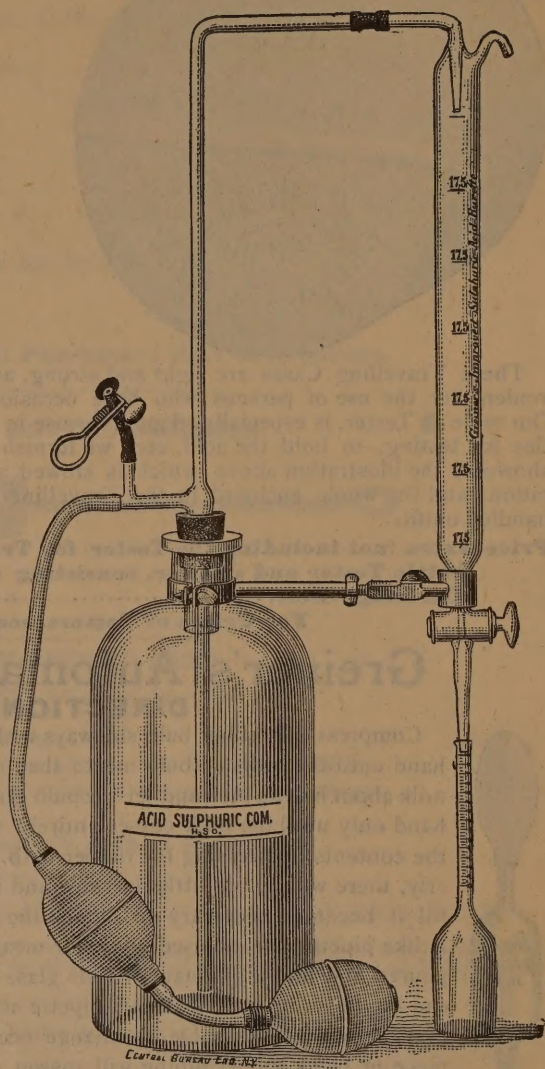
Price of Milk Pipette, each, packed in Box, \$1.00
 " Acid " " " " " 1.25

Greiner's Improved Sulphuric Acid Burette.

A practical apparatus by which to measure quickly and accurately the sulphuric acid for the Babcock Milk Test. In large creameries and factories where many tests are made during the day it has become necessary to have an apparatus by which to measure out the acid by a more convenient method than a graduated glass, and several appliances have been put on the market for that purpose, but most all of them have proved to be either too fragile or too cumbersome, and therefore were not adapted for practical work.

In using this burette it is simply necessary to take out the stopper of the acid bottle and insert the rubber stopper through which the syphon tube is put, then attach the clamp to the neck of the bottle and fasten the burette into the end of it. Connect the burette to the syphon tube by a small piece of pure gum tubing, attach the rubber bulb and pinch cock, as shown in cut, and the apparatus is ready for work. By compressing the end rubber bulb several times the acid is forced into the burette and pumping is carefully continued until the acid has just reached the top mark on the burette, when the pinch cock on the side of the syphon tube is opened by pressing it and the excess of acid will flow back into the bottle and the acid in the burette will remain exactly at the top mark and measuring can begin at once.

Care should be taken not to pump too forcibly, but just enough to make the acid flow into the burette to the top mark, and the moment the acid passes this mark open the pinch cock **at once**. When one acid bottle is emptied this apparatus can be attached to the next bottle, and so on, and as all parts can easily be replaced at a small cost, it will prove the most reasonable in price, and is without doubt the most practical ever gotten up for this purpose.



PRICE, NOT INCLUDING BOTTLE, COMPLETE, \$5.00.

DIRECTIONS

—FOR USING THE—

DR. BABCOCK MILK TEST,

—MANUFACTURED BY—

VERMONT FARM MACHINE CO., BELLOWS FALLS, VT.

Sampling the Milk. Every precaution should be taken to have the sample represent as nearly as possible the whole lot of milk from which it is taken. Milk fresh from the cow, while still warm and before the cream has separated in a layer, may be thoroughly mixed by pouring three or four times from one vessel to another. Samples taken at once from milk mixed in this way are the most satisfactory of any. Milk that has stood until a layer of cream has formed should be poured more times, until the cream is thoroughly broken up and the whole appears homogeneous. No clots of cream should appear upon the surface when the milk is left quiet for a moment. With proper care any milk that has not coagulated, or that has not been exposed to the air until the surface of the cream has become dried, may be mixed so that a representative sample may be taken. Milk should not be poured more times than is necessary, as continual mixing in this way is liable to churn the cream, forming little granules of butter that quickly rise to the surface. When this occurs it is impossible to obtain a fair sample. Milk is sometimes churned by being transported long distances in vessels that are not full. When this occurs it is useless to make an examination. To avoid this, fill the vessel absolutely full, so that there will be no motion, and pack in ice. A glass jar full of milk, packed in ice in a tight tin pail, seldom churns during transportation.

It is impracticable to sample a large amount of sour milk, but a small sample of a pint to a quart may be thoroughly mixed by adding five per cent. of strong ammonia water, which will dissolve the curd and permit a uniform mixture being made. When ammonia is added, the final results should be increased by five per cent. Samples from sour milk are, however, never as satisfactory as those taken when the milk is in a proper condition.

Measuring the Milk. When the milk has been sufficiently mixed, the milk pipette is filled by placing its lower end in the milk and sucking at the upper end until the milk rises above the mark on the stem; then remove the pipette from the mouth and quickly close the tube at the upper end by firmly pressing the end of the index finger upon it to prevent access of air; so long as this is done the milk cannot flow from the pipette. Holding the pipette in a perpendicular position, with the mark on a level with the eye, carefully relieve the pressure on the finger so as to admit air slowly to the space above the milk. When the upper surface of the milk coincides with the mark upon the stem, the pressure should be renewed to stop the flow of milk. Next, place the point of the pipette in the mouth of one of the test bottles, held in a slightly inclined position, so that the milk will flow down the side of the tube, leaving a space for the air to escape without clogging the neck, and remove the finger, allowing the milk to flow into the bottle. After waiting a short time for the pipette to drain, blow into the upper end

to expel the milk held by capillary attraction in the point. Before using the pipette, it should be filled with the milk to be tested, and this thrown away before taking the test sample. If several samples of the same milk are taken for comparison the milk should be poured once from one vessel to another after each sample is measured. Neglect of this precaution may make a perceptible difference in the results, through the separation of cream, especially when the milk examined is rich.

Persons who have had no experience in the use of a pipette will do well to practice a short time by measuring water into a test bottle before attempting to make an analysis. The manipulation is easily acquired, and with a little practice milk may be measured nearly as rapidly with a pipette as with a graduate, and with much greater accuracy.

Adding the Acid. When the milk has been measured into the test bottles, the necessary amount of acid may be added immediately, or the bottles may be left for a day or two without materially changing the results; samples that have remained in the test bottles more than a week have given the same amount of fat as samples tested immediately after being measured. If the milk has become coagulated, the curd should be broken up by shaking the test bottle before the acid is added.

The volume of acid required for a test is approximately the same as that of the milk, 17.5 c. c. for the ordinary test. If too little acid is added, the casein is not all held in solution throughout the test, and an imperfect separation of the fat results. If too much acid is used, the fat itself is attacked.

Great care must be taken in handling the acid to avoid getting any of it upon the skin or clothing, as it is very corrosive. If by accident any is spilled upon the hands or clothes, it should be washed off immediately, using plenty of water. A prompt application of ammonia water to clothing upon which acid is spilled, may prevent the destruction of the fabric, and restore the color.

When all of the samples of milk to be tested, or a sufficient number to fill the machine, are measured ready for the test, the acid measure is filled to the 17.5 c. c. mark with acid, and from this it is carefully poured into a test bottle, containing milk, that is held in a slightly inclined position for reasons given in directions for measuring the milk, and also that the acid may follow down the side of the bottle, and not come in contact with the milk too abruptly, so as to act upon the liquid unevenly. The acid being much heavier than milk, sinks directly to the bottom of the test bottle without mixing with the milk that floats upon it. The acid and milk should be thoroughly mixed together by gently shaking with a rotary motion. This mixing should be very thorough. A test cannot be overmixed, but is often not mixed enough. At first there is a precipitation of curd from the milk, but this rapidly dissolves. There is a large amount of heat evolved by the chemical action, and the solution, at first nearly colorless, soon changes to a very dark brown, owing to the charring of the milk sugar, and perhaps some other constituents of the milk.

It is generally best to mix each bottle as soon as the acid is added.

Sometimes imperfect separation occurs, and the fat is mixed with curdy matter. Black curd is generally caused by too strong acid, too warm milk, or both. White curd is usually caused by too weak an acid. The best results can be obtained with the milk at a temperature of from 60 to 70 degrees.

Upon standing a short time the fat begins to collect upon the surface, not in a clear layer, but having at first the appearance of a dirty cream. The separation of fat by gravity alone is not complete even when the bottles are left standing for several hours; with the centrifuge, however, a perfect separation is accomplished in a few minutes.

Whirling the Bottles. The test bottles containing the mixture of milk and acid may be placed in the machine directly after the acid is added, or they may stand several hours without harm. An even number of bottles should be whirled at the same time, and they should be placed in the wheel in pairs opposite to each other, so that the equilibrium of the apparatus will not be disturbed. When all of the test bottles are placed in the apparatus, the cover is placed upon the jacket, and the machine is turned either by hand or by power at such a rate that the wheel carrying the bottles will make from 700 to 1,200 revolutions per minute, and this motion must be kept up for six or seven minutes. The crank should be turned from 40 to 90 revolutions per minute in order to give the required speed to the bottles, **depending upon the style of machine and the size of bottle-head. See descriptions of Testers.**

When the bottles are placed in the machine directly after the acid is added, the separation may be effected without any extra heat, as that caused by the chemical action is sufficient to keep the fat liquid. If the bottles have stood after the acid is added until the contents are cooled below 100° F., the water in the tank should be warmed to about 200° F. before putting the bottles in the machine. The bottles should not be kept heated in the machine as high as the boiling point of water while the separation is being effected. The proper degree of heat may be obtained by lighting a burner or kerosene stove under the jacket when the machine is started; so much water having been poured into the jacket as will be just heated to boiling when the whirling is finished. In creameries, heat can be most easily supplied by steam connection with the boiler. If the machine is stopped after about six minutes, a layer of fat will be found upon the upper surface of the liquid in the tubes. This fat will not usually be clear; this, however, will make no difference in the result, as the subsequent treatment will clarify it.

Adding Hot Water. As soon as the bottles have been sufficiently whirled, they should be filled to the base of the neck with hot water. This is most conveniently done by placing a vessel containing boiling water above the machine, and by means of the syphon and small rubber tube (see price list), run the water directly into the bottles without removing them from the wheel. If only a few tests are to be made, the bottles may be easily filled with a pipette, or by pouring from a graduate. The cover should then be replaced and the machine turned for two or three minutes, after which more hot water is added, filling the tube to about the seven per cent mark. The fat will slowly rise into the graduated tube, losing its cloudy appearance as it passes through the hot water. When all the bottles are filled, the cover is put upon the tank, and the machine again turned for one or two minutes. During this time the water in the tank should be kept hot, either by placing a lamp or kerosene stove beneath it, or by pouring in a quantity of boiling hot water before starting the machine. If the fat in some of the tubes still has a cloudy appearance, the cover should be placed upon the tank and heat applied for a few minutes, when the fat should become clear and in condition to be measured. The clearing may be hastened by whirling the bottles in the machine while hot. When the bottles are allowed to cool off to a point where the fat will crystallize and then warmed again, the fat will usually be much clearer than before, but as this does not materially change the volume of fat it is considered unnecessary. Even a light cloudy appearance does no harm.

Measuring the Fat. The fat when measured should be warm enough to flow readily, so that the line between the acid liquid and the column of fat will quickly assume a horizontal position when the bottle is removed from the machine. Any temperature between 110° F. and 150° F. will answer, but the higher temperature is to be pre-

ferred. The slight difference in the volume of fat due to this difference in temperature is not sufficient to materially affect results. A difference in temperature of 40° F. will make less than one-tenth of one per cent difference in milk containing five per cent of fat. To measure the fat, take a bottle from its socket, and holding it in a perpendicular position with the scale on a level with the eye, observe the divisions which mark the highest and lowest limits of the fat. The fat should be read from the extreme top of the curved upper surface, not from the bottom or middle of the same. The difference between these gives the per cent. of fat directly. The reading can easily be taken to half divisions or to one-tenth of one per cent.

If the column of fat is less than about one division, as will sometimes happen with skim-milk, butter-milk or whey, it may assume a globular form instead of a uniform layer across the tube; when this occurs the fat can usually be estimated with sufficient accuracy by simple inspection.

EXAMPLE.

The figures on the neck of the bottles give the per cent of butter fat, for example, as from 0 to 3, would be 3 per cent. Space between the figures represents one per cent, each space between the lines is two tenths of one per cent, thus if the bottom of the oil in the neck of the bottle should stand at the figure 2 and the top at the third fine line above the figure 6, you would have four and six-tenths per cent (4.6). Each per cent represents one pound of butter fat in one hundred pounds of milk.

CLEANING THE BOTTLES.

The bottles should be emptied while hot and afterwards rinsed twice with boiling hot water; they are then ready for another test. In emptying the bottles they should be inverted and given a circular motion, which causes the liquid to form a whirlpool and allows the air to enter continuously in the center of the tube; in this way the bottles may be emptied and cleaned rapidly, without leaving fat attached to their sides. A little washing soda dissolved in hot water aids in cleaning the bottles.

See price list for price of Bottle Cleaning Brush.

SURPLUS BUTTER.

It must be borne in mind that the Babcock Test gives only the amount of butter fat in the milk or cream, and that the finished product of butter contains several ingredients other than butter fat, so that the amount of butter shows an increase ranging from ten per cent to eighteen per cent. Therefore in figuring the amount of butter made, this increase should be added to the amount of butter fat which is shown by the Babcock Test.

Some creameries add this increase to the price of the butter. Others add it to the quantity of butter and then figure the price of the butter at what it actually brings. In comparing returns from different creameries, it should be ascertained whether each creamery is figuring the price on the butter fat and paying per pound of butter fat, or whether one is paying per pound of butter fat and another per pound of butter actually made. If the increase is added to the price, in the first creamery, and in the second creamery it is added to the amount of butter instead of to the price, then the latter creamery would suffer in the supposed price paid as compared with the former; and while it would appear that the latter creamery paid less per pound, if you should go back and figure both on the basis of the butter fat, it might prove that it really paid more than the former. Therefore in comparing the prices paid by different creameries, this difference in the methods of paying should be understood, as no true comparison can be made unless figured upon the same basis.

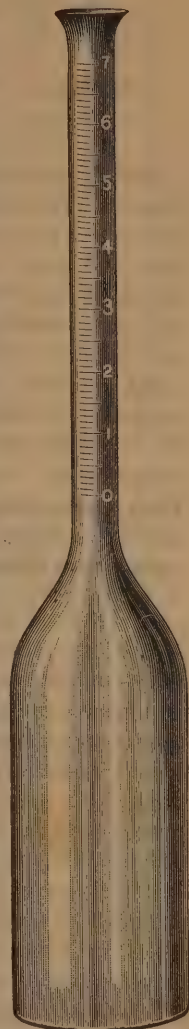
Composite Tests.

Composite tests may be taken in one of three ways, all of which are accurate, but the first method described below is preferred, as fewer bottles are used, no transfer of milk from one bottle to another is made, no preservative is needed and less time is required.

1. Using Composite Test Bottles with a 5 c. c. Pipette.—A most satisfactory composite test may be made by using bottles twice the size of the regular milk bottles, one for each patron, and measuring into these with a 5 c. c. pipette, a sample of each patron's milk every day for seven days. The bottle will then contain double the usual test sample of milk, and by adding double the usual amount of acid, or 35 c. c., the test may be completed as with fresh milk. It is well to shake up the contents of the bottle before adding the acid. The reading will give the per cent of fat in the sample. Add together the weights of the milk each day from which the samples were taken, and multiply the sum by the per cent of fat, and you will have the pounds of butter-fat in the week's milk. The result is the same as by daily testing and saves six-sevenths of the time of testing and figuring. Each space on this bottle represents one-tenth of one per cent.

2. Using Standard Milk Bottles with a 17.5 c. c. Pipette.—In making tests on this plan a glass fruit jar should be provided for each patron, into which a measured sample of the milk which he brings each day is placed. The daily sample may be taken after careful stirring with a long handled dipper, by means of a tube taking a core through the milk or by means of some form of automatic contrivance, such as a hole punched in the conductor-head, or a set-cock let into the side at the base of the weigh-can. Whenever a fresh sample of milk is placed in the jar it should be mixed with the milk previously added by giving the jar a rotary motion: unless this is done, the cream which separates will adhere to the sides of the jar and prevent the taking of an accurate sample when the test is made. The jars should be tightly closed after each sample of milk is added, and should be kept in a cool place during the week. When ready for the test about one-half teaspoonful of powdered lye is added, such as is sold by grocers, in small cans, for making soap. Add the half teaspoonful of lye, a little at a time, to each jar, which should be shaken occasionally, or the contents poured from one jar to another, until the curdled milk has all dissolved and the cream becomes mingled with the milk. The whole process of thinning the thick sour milk with lye is aided by warming the milk to a temperature of 100° to 140° F., and by letting it stand for an hour or more. Covers should be kept upon the jars when warmed to prevent evaporation. Time and heat both help the solvent action. Pouring from one jar to another is also an important factor in getting the milk thoroughly mixed. When the milk in the jar has become thin and homogeneous, a sample may be measured and tested for fat in exactly the same way as with new milk. Tests of this kind should not extend over a longer period than one week. Be sure to read carefully the full instructions for **Measuring, Adding the Acid, Whirling the Bottles, etc.**, contained in directions for **Milk Test**, which are sent with each machine.

3. Using the Standard Milk Bottles with a 5.9 c. c. Pipette.—A composite test for three days can be obtained by using the ordinary milk bottles and sampling daily with a 5.9 c. c. Pipette, making the test just the same as with fresh milk. The objections to this method are that more care is required in taking the daily samples and in case of accident in making the test the record for the time covered by the composite sample is lost. The result is accurate and the time required less than by any other method.



Some New Points in the Manipulation of the Babcock Milk Test.

By Prof. E. H. FARRINGTON, Chemist, Illinois Experiment Station.

Testing milk by Dr. Babcock's method has generally been considered a very simple process. The details of the method were so elaborately and carefully worked out by him, before publication, that no improvements in the chemical reactions have been suggested to make the process any more useful or successful than when first described. Beginners have found, however, that to make an accurate test of milk requires somewhat more attention than is necessary to turn the crank of a churn. Many who have used the process have had more or less trouble from foreign substances, either black or white, separating with the fat. These make an obscure reading of the per cent of fat because of the indistinct separation of the liquids. The common remedy suggested for this difficulty has been a change of acid. If there is "black stuff" in the fat, get a weaker acid; if a white curd separates in the fat column change to a stronger acid. **That a too strong or a too weak acid may cause this trouble is undoubtedly correct in many cases, but not always. The manipulation of the test may also cause these defects.**

It was found by the writer that nearly if not all the acid sold in Chicago for this purpose was made at one factory, and by conversation with the manufacturer it was learned that the still making this acid was running day and night, turning out the same quality of acid without change.

It has generally been supposed to be easier to test a mixture of the milk of several cows than the milk of one cow, and that possibly there might be found a cow's milk which could not be successfully tested. The observations given in this article are the results of a great many experiments made with the milk of each of the seventy-five cows now in the dairy test at the World's Columbian Exposition.

Since May first we have made at least 150 tests of milk every day. During this time samples of a great variety of milks have been tested. There have been great variations in the composition of these milks and in the characteristics and health of the cows. We have been able to test successfully **any milk** yet received, and by proper manipulation, to get a very clear separation of the fat.

A bad separation is not always caused by the strength of the sulphuric acid. Our work has demonstrated that, by slight changes in the manipulation, at least **three kinds of tests** can be made of one sample of milk with the **same acid**.

First, a test giving a very clear separation of fat; *second*, a separation of fat which contains more or less of a black, flocculent substance, especially at the bottom of the fat column; and, *third*, a test very much like the second, except that a white, instead of a black substance, interferes with a clear measurement of the fat.

The black substance that appears is probably charred fat and indicates **too strong an action of the acid on the milk**. The white adulteration of the fat shows either **too weak** a reaction or an **incomplete separation by the centrifuge**. Each of these defects can, of course, be produced by acid either very much too strong or too weak. They can also be brought out, by different manipulation, when acid having the correct strength is used.

If the acid is so **poured** into the milk in the test bottle that it passes **through the milk**, instead of **following down the inside walls** of the test bottle, a portion of the milk is thus acted on by the strong acid before it becomes diluted with the water in the milk. This makes a more intense action of the acid on a small part of the milk, and the fat it contains is somewhat decomposed and blackened. This black substance is then separated with the fat by the usual method of finishing the test and makes the measurement of the fat uncertain.

Another cause of the "black stuff" in the fat is **too warm milk**. Sulphuric acid, sp. gr. 1.82, may work all right for testing milk when both acid and milk are at a temperature of 60° F.; but if the weather changes, or the testing is made in a warm room where the temperature is up to 80° or 90° F., a great deal of black stuff may be found in the fat.

The action of the acid on the milk will be more or less intense, according to the temperature of the liquids. Persons who have tested milk throughout the year, at creameries or other places, may have noticed that in winter the fat is often **light colored or whitish**, while in summer it is **deeper yellow**. This variation in color is caused by the difference in the temperature of the milk and acid as well as the strength of the acid. **Cooling the milk** in the test bottles, before adding acid, will often prevent the formation of the black substance which appears in the column of fat.

The **white, curdy substance** that sometimes separates with the fat can be destroyed either by adding the hot water necessary to bring the fat into the neck of the test bottle, in two portions, and whirling the test bottle in the centrifuge after each addition of the water, or by warming the milk in the test bottles, so that it will be about 80° F. when the acid is added.

It is my opinion that returning the supply of acid to the party from whom it was bought is often unnecessary. Any person who has trouble from either the black or white substance separating with the fat can probably remedy the difficulty by some changes in the manipulation, provided the acid is anywhere between 1.82 and 1.83 sp. gr. at 60° F.

No exact experiments have been made yet to determine the relation between the temperature of the milk and acid, and the sp. gr. of the acid, but I will venture to guarantee an entirely satisfactory working of the Babcock milk test if, in addition to the elaborate details which the originator of the method has already worked out, the following precautions are observed:

First—An acid having **1.82** sp. gr. should be used with milk at **60° to 70° F.** If the acid is stronger, cool the milk to a lower temperature. Somewhat **weaker** acid can probably be made to work all right by **warming** the milk.

Second—When measuring the acid into the test bottles, hold the **bottle at an angle** that will cause the acid to follow the inside walls to the bottom of the bottle and not **drop through the milk in the center** of the bottle. If properly poured into the test bottle there will be a distinct layer of milk and acid with little or no black color between them.

Third—Thoroughly **mix** the milk and acid **as soon as measured** into the test bottle. A better separation of fat is obtained by mixing at once than by allowing the two liquids to stand unmixed in the bottle until enough tests have been measured out to fill the centrifuge.

Fourth—After five minutes whirling of the test bottles in the centrifuge, add hot water until the test **bottle is filled up to the neck only**; run the centrifuge one minute, then **fill the neck of the test bottle** with hot water and run the centrifuge another minute. Adding the necessary hot water in two portions is often a great help in getting a clear separation of fat. When the test bottles are taken from the centrifuge they are put into water at 140° to 160° F., and the per cent of fat read at that temperature.

Fifth—Too low results will be obtained if the centrifuge does not have sufficient speed. The machines have to be watched, as constant use wears some of them so that the speed designed by the manufacturer is not obtained.

Sixth—When testing skim milks or buttermilks which have a very small per cent of fat (two-tenths of one per cent or less), the reading of the per cent of fat should be made immediately on taking the test bottle from the centrifuge. If this is not done, and the test bottle cools before taking the reading, the contraction of the liquid in the bottle will often leave the fat spread over the inside surface of the measuring tube so that it is not seen but has the appearance of being only a dirty tube. If read when taken from the machine, the small globules of fat can be seen and estimated.

It has been stated by foreign critics that one reason why they did not use the Babcock milk test was because their work in the dairy line had been done for years by the old methods long in use, and in order to make their present and future work compare with the past they must use the same old methods of their fathers. Our work for the past two months has given each day triplicate proof of the accuracy of the Babcock method for testing milk. The milk of each of the three herds of twenty-five cows is creamed and churned daily. The skim milk and buttermilk are tested, and the butter from each herd analyzed every day. The butter fat, found by testing the milk of each of the twenty-five cows in each herd, is nearly all accounted for by the analyses of the skim-milk, buttermilk, and butter.

The records show that from June 1st to Aug. 3rd there has been an average loss in fat of 0.166, 0.161 and 0.153 per cent of the total milk produced by the three herds. This small loss of fat by the manufacture of milk into butter demonstrates that if this method is correctly used in dairy experiments, and the results of such investigations are not comparable with those of the past, it is not the Babcock milk test which is wrong. There is some other cause for the discrepancy.

**If in need of any apparatus for the Dairy or Butter Factory
please write for illustrated circulars and specify the articles
desired. Our Circulars are mailed free of charge.**

The Babcock Test for Cream,

AS RECOMMENDED BY THE CONNECTICUT EXPERIMENT STATION.

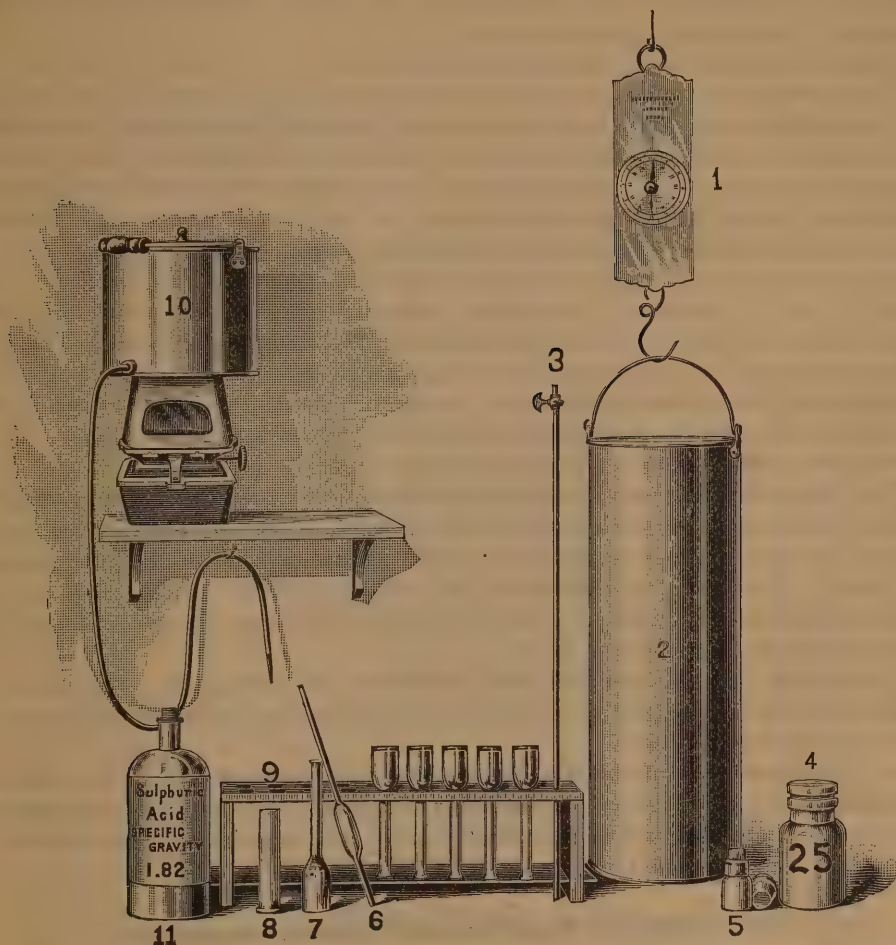


Plate No. 1.

On the following pages is a full description of the system which some of the creameries in Connecticut have adopted, at the suggestion of the Connecticut Experiment Station, and which, it is believed, secures to all the patrons fair payment for the cream furnished.

The plan is briefly as follows: The cream is skimmed and weighed by the cream-gatherer, who also takes a sample accurately representing the entire cream, both as to its quantity and quality. The samples of each patron's cream gathered from day to day are mixed and make a "composite sample" which is kept from curdling by a preservative and is finally tested by the Babcock method.

From the total weight of cream gathered and the per cent of fat in it, the actual weight of butter-fat furnished by each patron is determined and is placed to his credit. Spaces are not taken into account.

Apparatus for Sampling and Weighing the Cream.

SEE PLATE I.

Pail for sampling and weighing.—For this purpose we furnish a pail having a stout bale by which it will hang straight from a spring scale. For patrons that furnish little cream—10 pounds or less per gathering—a pail of half the diameter and one-fourth of the capacity may be found useful.

The sampling pail should weigh exactly 5 pounds.

Spring balance.—We furnish a spring balance weighing 60 pounds by two ounces (See price list of extras.) In order to avoid calculation, the index should be set back one quarter of the circle, which is equivalent to 5 pounds, so that when the empty pail hangs on the balance the index stands at 0. This balance should hang from a proper support at the back of the gatherer's wagon, at such height that the pail full of cream can be hung on it handily but will not touch the ground.

Sampling tube.—This tube is 25 inches long, $\frac{3}{16}$ of an inch bore, and of metal about $\frac{1}{32}$ of an inch thick. (See figure 3, plate 1. When the amount of cream furnished by the individual patrons is small, a tube of $\frac{1}{4}$ inch bore may be preferable.) On the upper end, a small brass stop cock of the same bore is screwed. Both tube and cock are nickel plated inside and out, to make a smooth, untarnished surface. The tube when not in use should be kept in an upright position to permit draining.

Sample bottles.—Two sets of sample bottles are used.

(1.) **Collecting bottles.**—Small, wide-mouthed bottles, holding from one to one and one-half fluid ounces, closed by good corks, are suited for carrying the collected samples. Numbers corresponding to the different patrons, are burned into the tops of the corks. The bottles themselves are not otherwise marked. These are taken by the cream-gatherer on each trip, to receive the samples that represent every lot of cream collected. See Figure 5, Plate 1.

The gatherer should be provided with one of our convenient cases, having a compartment for each bottle, and a cover which, when closed and fastened, will hold the corks securely in their places.

(2.) **Composite sample bottles.**—Half-pint "Lightning" fruit jars, or wide mouthed bottles of convenient size fitted with corks, are used for this purpose. The bottles should not be much larger than is necessary to hold the largest of the composite samples. See Figure 4, Plate 1.

Instructions for Sampling and Weighing the Cream.

Numbering of patrons.—The patrons are conveniently distinguished by numbers, and the corks of the sample bottles should bear corresponding numbers. To avoid error, each patron's number should be posted in a conspicuous place near his creamer.

Skimming.—The cream is skimmed by the cream gatherers or by the patrons of the creamery, whichever method is required by the rules of the creamery association. The sampling of the cream and the weighing is always done by the cream gatherer. If separators are used they must be so gauged as to run cream of about the same thickness as Cooley cream, i. e., with not more than 25 per cent, preferably from 18 to 20 per cent, of fat. Pan-set cream, or cream that is frozen or sour, cannot be accurately sampled, and should be rejected for this, if for no other reason.

Mixing the cream.—Pour each patron's cream at least twice from one vessel to another. The last pouring should bring it into the weighing pail. **It is absolutely essential that the cream should be thoroughly mixed before sampling. This is the most critical part of the whole operation.** If there is enough cream to fill the weighing pail more than once, each pailful should be carefully mixed and sampled.

Sampling and weighing.—Lower the sampling tube *with the cock open*, to the bottom of the weighing pail which holds the mixed cream. When it is filled raise it out of the liquid and allow it to drain for a few seconds. By this means the tube is rinsed with the cream to be sampled and any traces of cream adhering to the tube from previous use are removed. With the cock still open, slowly lower the sampling tube to the bottom of the cream pail. After allowing a moment for the cream to rise in the tube to the same height as in the pail, close the cock and raise the sampler carefully out of the cream. As long as the cock is closed the cream in the tube will not flow out, unless the tube is strongly jarred. Allow the cream adhering to the outside of the tube to drain off for a few seconds, then put the lower end into the collecting bottle, which bears the patron's number on its cork, and open the cock. The cream will then flow out of the sampler into the bottle, which is afterwards securely corked and put into the cream-gatherer's case. Immediately weigh the cream in the cream pail to the quarter or half pound, as may be judged expedient, and record the weight.

If the patron has more than one pailful, repeat with each pailful the operation of sampling and weighing, putting all the samples in one and the same bottle. *Weigh all cream collected, in one and the same sampling pail, and draw a sample from each separate portion weighed.*

In case a patron has so little cream that a single portion drawn by the tube from day to day will not be sufficient to make a composite sample large enough for testing, two or more cores may be taken, *but at every gathering the same number.* If two cores are taken today, then two must be taken tomorrow and every day until the test is made; if three cores, then three every day.

Operating according to these directions, the sample not only represents the quality of the whole amount of cream, but is also proportional to its quantity. If a patron furnishes twice as much cream today as he did yesterday, the sample drawn from today's cream will also be twice as large as yesterday's, and if there is a decided difference in the quality of cream on the two days, this method of sampling will make due account of it in the composite sample.

When the whole quantity of cream is very small, less than half a pailful, it is best not to take a sample in the way above described, but putting the sampler in the cream, apply the mouth to the stop cock and suck the sampler full, close the cock and transfer this sample to the collecting bottle.

The size of the sample taken in this way does not correspond to the quantity of cream, but the possible error thus introduced is inconsiderable when the quantity of cream is small and nearly alike from day to day.

If, however, it is desired to be more exact, small lots of cream can be sampled in the way first described, in a pail having a diameter of four inches.

A given quantity of cream in this pail will have four times the depth which it has in the larger one and the sampler will therefore draw a sample four times as large.

The Composite Sample.

Preservative.—Bichromate of potash when added in the proportion of one grain of the salt to two ounces of cream, will keep the latter (in a cool place) in a suitable condition for testing for at least one week. A pistol cartridge shell, of .22-inch calibre,

cut to a length of $\frac{1}{4}$ inch, will hold, when loosely filled, enough of finely powdered bichromate to preserve one-quarter of a pint of cream.

- A .22-inch calibre shell cut to $\frac{1}{2}$ inch long holds enough to preserve $\frac{1}{2}$ pint.
- A .32-inch calibre shell cut to $\frac{1}{4}$ inch long holds enough to preserve $\frac{1}{2}$ pint.
- A .32-inch calibre shell cut to $\frac{1}{2}$ inch long holds enough to preserve 1 pint.

Convenient measures can be made by cutting off shells to the proper length with a file and soldering on a piece of wire for a handle.

When beginning a series of tests, place in each composite sample bottle the quantity of powdered bichromate of potash required for keeping one-quarter of a pint of cream. If the quantity at any time amounts to more than this, more bichromate may be added. **This substance is very poisonous.**

Transferring the samples —As soon as the collected samples arrive at the creamery, shake each moderately, pour it into the composite sample bottle bearing the corresponding number, and allow the collecting bottle to drain for a moment. Cork the composite sample bottle and give it a rotary motion to mix the new cream with that previously collected, as well as with the bichromate. If this is not done, the thick layer which has risen since the last addition of cream, may adhere to the side of the bottle and finally interfere with taking the portion for testing. Keep the samples in a cool place, but do not allow them to freeze. The small collecting bottles and corks should be put into hot water at once, or before the adhering cream dries to them, should be washed, dried and placed in the cases ready for the next collecting trip. Since only the corks are marked, no confusion of bottles can arise.

Apparatus for testing cream by the Babcock Method.

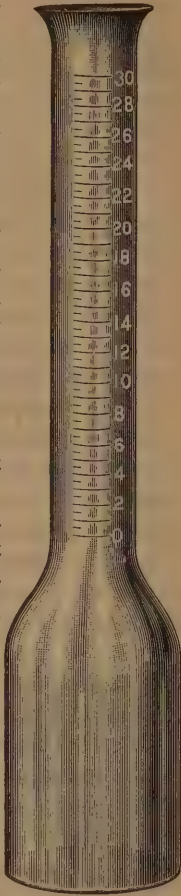
Test Bottles.—The form of cream bottle devised by Mr. Winton, of the Connecticut Experiment Station, is suited for creamery use. (See illustration.) It has a wider neck than the bottles used for testing milk. The neck is graduated from 0 to 30 per cent., but the readings can be readily made to a quarter of a per cent.

We can also furnish the Bartlett Cream Bottle, adopted by the Maine Experiment Station.

The Connecticut Cream Bottle can be used in the same size tank as required for the regular Babcock milk bottle. The Bartlett Cream bottle is a little taller and requires a tank that is made a trifle taller. Of course the regular milk bottles could also be used in this tank.



Bartlett Cream Bottle.



Connecticut Cream Bottle.

The Connecticut Cream Bottles will always be sent unless otherwise specified.

Pipettes.—The cream is measured in a pipette delivering 18 cubic centimeters. The opening at the lower end is rather larger than for milk pipettes, so that the cream, which is thicker than milk, will deliver readily.

Acid Measure.—This is a glass graduate, which delivers, when filled to the mark, 17.5 cubic centimeters. (See page 2).

Centrifugal Machine.—Our V. F. M. Steam Turbine Testers are especially adapted for creamery use. The power is communicated by a jet of steam, playing into pockets attached to the rim of the wheel which carries the bottles. By this device the time and

labor consumed in operating the hand machines are spared and the more complicated machinery of the power testers is avoided. The escaping steam keeps the contents of the bottles from cooling, and after the last whirling, the fat is at a proper temperature for measuring. The wheel to which the bottles are attached should make, during the test, from **700 to 1200** revolutions per minute, according to its diameter; 700 revolutions being sufficient for the larger wheels with a diameter of about 20 inches, while 12-inch wheels should run at the rate of 1200 revolutions per minute. The machine has a spindle to which a speed indicator can be applied, and it should be tested from time to time to make sure that it is working properly. Be sure that the steam pipe is large enough to deliver *dry steam* and that while the tester is running, the steam is not used elsewhere in such quantity as to interfere.

Caution in regard to acid.—The acid should be kept in tightly stoppered bottles, as otherwise it rapidly absorbs moisture from the air and becomes too weak. The stopper should be of either glass or rubber and not of cork which is rapidly destroyed by the acid. This oil of vitriol is extremely corrosive. It will ruin very quickly, clothing or leather on which it falls and soon makes painful burns if in contact with the skin. If the hands come in contact with it they should be immediately and thoroughly rinsed. Sal-soda or wood ashes will neutralize it and check its corrosive action. The greatest care must be used in handling this acid.

Apparatus for filling the test bottles with hot water.—A convenient arrangement for this purpose is shown in figure 10 in plate I, which we furnish if desired. For use the pail is filled with boiling hot water and placed on a support a foot or two above the machine, thus giving the necessary head. By opening and closing the pinch-cock, the hot water may be delivered in the bottles, in proper quantity.

Rack for draining the bottles.—This is shown in figure 9 in the plate and needs no further comment.

Making the Test.

Weekly tests are recommended.—Tests need not be made oftener than once a week.

Mixing the sample.—Shake the composite sample bottle until the cream is thoroughly mixed, and of uniform consistency.

Measuring the cream.—Immediately after mixing, the pipette is filled by placing its lower end in the cream and sucking at the upper end until the cream rises above the mark on the stem; then remove the pipette from the mouth and quickly close the tube at the upper end by firmly pressing the end of the fore-finger to prevent access of air. So long as this is done the cream cannot flow from the pipette. Holding the pipette in a perpendicular position, with the mark on a level with the eye, carefully relieve the pressure of the finger so as to admit air slowly to the space above the cream. In order to more easily control the access of air both the finger and end of the pipette should be dry. When the upper surface of the cream coincides with the mark upon the stem, the pressure should be again applied to stop the flow of cream. Next, place the point of the pipette in the mouth of one of the test bottles, and removing the finger allow the cream to flow into the bottle. After waiting a short time for the pipette to drain, blow into the upper end to expel the cream held in the point. Before using the pipette should be filled with the cream to be tested, and this thrown away before taking the test sample.

Persons who have had no experience in the use of the pipette will do well to practice a short time by measuring water into a test bottle before attempting to make a test.

Adding the acid.—After the cream has been measured into the test bottle the test may be proceeded with immediately, or the bottles may be left for a day or two without materially changing the results; samples that have remained in the test bottles two or

three weeks and which had commenced to mould before the acid was added, have given the same amount of fat as samples tested immediately after being measured. If the cream has become coagulated, the curd should be broken up by shaking the test bottle before the acid is added. It is advisable, however, that the test be proceeded with immediately after the samples are measured, if possible.

The volume of commercial sulphuric acid required for a test is approximately the same as that of the cream, or 17.5 c. c. for the ordinary test. If too little acid is added, the casein is not all held in solution throughout the test, and an imperfect separation of the fat results. If too much acid is used, the fat itself is attacked.

Great care must be taken in handling the acid to avoid getting any of it upon the skin or clothing, as it is very corrosive. If by accident any is spilled upon the hands or clothes, it should be washed off immediately, using plenty of water. A prompt application of ammonia water to clothing upon which acid is spilled may prevent the destruction of the fabric and restore the color.

When all the samples of cream to be tested are measured ready for the test, the acid measure is filled to the 17.5 c. c. mark with sulphuric acid, and from this it is carefully poured into a test bottle containing the cream. The acid being much the heavier, sinks directly to the bottom of the test bottle without mixing with the cream that floats upon it. The acid and cream should be *thoroughly mixed* together by gently shaking with a rotary motion. At first there is a precipitation of curd, but this rapidly dissolves. Much heat is evolved by the chemical action, and the solution, at first nearly colorless, soon changes to a very dark brown, owing to the charring of the milk sugar.

Whirling the bottles.—The test bottles containing the mixture of cream and acid should be placed in the machine and whirled directly after the acid is added. An even number of bottles should be whirled at the same time and they should be placed in the wheel in pairs opposite to each other, so that the equilibrium of the apparatus will not be disturbed. When all the test bottles are in the apparatus, the cover is placed upon the jacket and the machine turned at the proper speed for about five minutes. The test should never be made without the cover being placed upon the jacket, as this not only prevents the cooling of the bottles when they are whirled, but in case of the breakage of bottles, may protect the face and eyes of the operator from injury, by pieces of glass or hot acid.

The machine should be frequently tested with the speed indicator to make certain that the bottles are whirled at the required speed. Too slow motion results in imperfect separation of butter-fat.

If a steam turbine is not used, the test bottles should be whirled immediately after adding the acid. In case of delay they must be heated to a temperature of about 200 ° Fahr. before putting them in the machine.

Filling the bottles with hot water.—As soon as the bottles have been sufficiently whirled, they should be filled to the neck with hot water. If practicable, distilled or rain water should be used for the purpose. The bottles are most conveniently filled by help of the apparatus already mentioned; the flow of water can be perfectly controlled by the pinch-cock upon the rubber tube. If only a few tests are to be made the bottles may be filled with a pipette, or by pouring from a graduate. The cover should then be replaced and the machine turned for about two minutes. Hot water is now added to fill the test bottles about to the 28 percent mark, and after whirling for about one minute longer, the fat is ready for measuring.

Measuring the fat.—The fat when measured should still be hot to the touch.

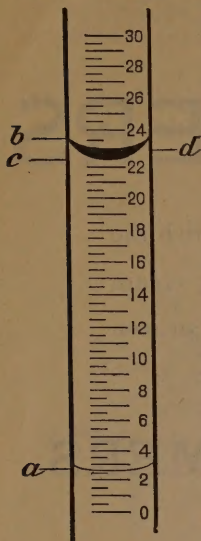


Fig. 4.

To measure the fat, take a bottle from its socket, and holding it in a perpendicular position with the scale on a level with the eye, observe the divisions which mark the highest and lowest limits of the fat. The difference between these gives the per cent of fat directly.

The line of division between the fat and the liquid beneath is nearly a straight line and no doubt need arise concerning the reading at this point, but the upper surface of the fat being concave, errors often occur by reading from the wrong place. The reading should be taken at the line where the upper surface of the fat meets the side of the tube, and not from surface of fat in the center of the tube, nor from the bottom of the dark line caused by the refraction of the curved surface. For instance, in Fig. 4 the reading should be taken from *a* to *b* and not to *c* or *d*.

The reading may be made with less liability of error by measuring the length of the column of fat with a pair of dividers, one point of which is placed at the bottom and the other at the upper limit of the fat. The dividers are then removed and one point being placed at the **O** mark of the scale on the bottle used, the other will be at the per cent of fat in the cream examined.

Sometimes bubbles of air collect at the upper surface of the column of fat and prevent a close reading; in such cases a few drops of strong alcohol (over 90 per cent) put into the tube on top of the column of fat, will cause the bubbles to disappear and give a sharp line between the fat and alcohol for reading. Whenever alcohol is used for this purpose, the reading should be taken directly after the alcohol is added, as after it has stood for a time, the alcohol partially unites with the fat and increases its volume.

Whenever the fat is not quite clear, more satisfactory results may be obtained by allowing the bottles to stand until the fat has solidified and then warm them by placing the bottles in hot water before taking the reading.

The way of reading is illustrated in the figure. The bottom of the clear yellow liquid fat layer is at *a*. The upper surface is represented by *b*, *c*, *d*. The readings are 2.75 and 23.75. The difference, 21.00, is the per cent of fat in this sample of cream.

After satisfactory tests have been made on all the samples, the cream that remains in the sample bottles is thrown away.

Cleaning the test bottles.—If the fat has solidified by cooling, warm until it is melted. This may be done by replacing the bottles in the machine and turning on the steam, or by running hot water over the bottles from the apparatus shown in figure 10 in the plate. Give each bottle a quick motion so as to throw out the fat, then empty out the remainder of the liquid, shaking all the time to loosen the white sediment on the bottom. Fill to the brim with boiling water, and place in the rack to empty and drain. After wiping off the outside with a cloth, the tubes, although not perfectly clean, are free from fat and ready for use again.

Book-Keeping of the Test System.

The pounds of cream sent by each patron from day to day, are recorded just as spaces are recorded. The number of pounds of fat to be credited to each patron is calculated from the number of pounds of cream and the per cent of fat found in the composite sample. If the composite samples are tested four times each month, the sum of the numbers of pounds of fat found at each of the four testings is the amount for which the patron is to be paid. The amount of money to be distributed, divided by the total pounds of fat received by the creamery for the month, gives the price to be paid for each pound of fat. This price per pound of fat, multiplied by the pounds of fat credited to any one patron, gives the amount due him.

We Not Only Furnish the **BEST**

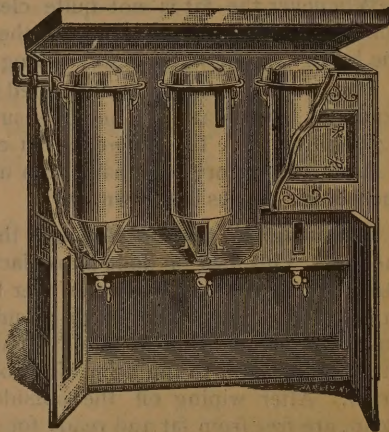
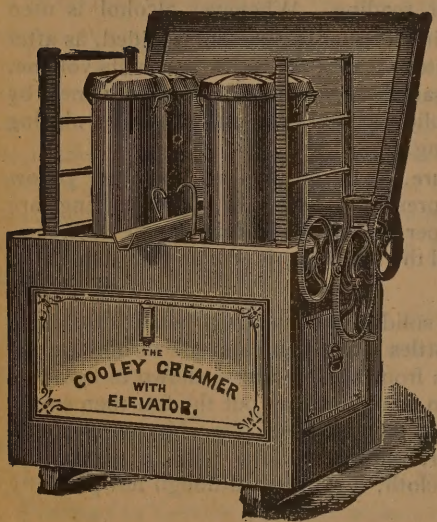
BABCOCK TESTERS

For determining efficiency of creaming, but we furnish the
Best Apparatus in the World for separating cream
 from milk, whose work we are always glad to have proven
 by the **Babcock Test**, viz.: : : : : : : :

THE-- COOLEY -- CREAMERS

— OR —

Centrifugal Cream Separators.



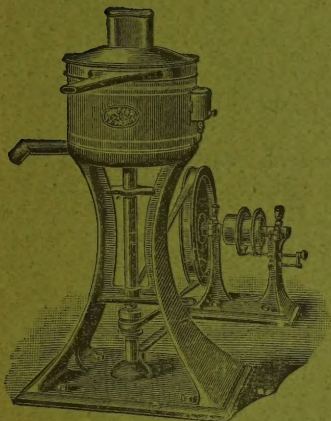
For proof of the close work of the **Cooley Creamers**, send
 for our Special Catalogue giving, among others, details of tests by
 the **Maine and Connecticut Experiment Stations**; or,
 better still, buy a Creamer and satisfy yourself. : : : : :

**OUR GOODS, FOR WHATEVER PURPOSE THEY ARE TO BE USED,
 ARE THE BEST OF THEIR CLASS.**

THE IMPROVED United States Cream Separators.

(OHLSSON PATENTS.)

Send for Special Catalogue.



Factory Sizes.

Full Capacity,

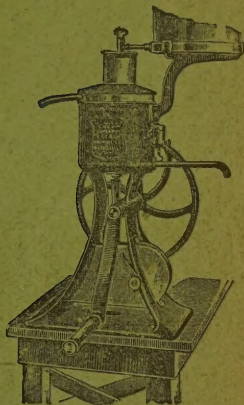
Close Skimming,

Easily Cleaned,

Superior Workmanship,

Simplicity,

Durability.



Dairy Sizes.

0.03 of 1 per cent at the Vermont Experiment Station Dairy School.

Your No. 3 machine handled 398 pounds of milk this morning at the rate of 603 pounds per hour, taking but $1\frac{1}{4}$ per cent of cream, and leaving but 0.03 per cent of fat in the skim milk. Permit me to congratulate you on the excellence of this work.

Burlington, Vt., Feb. 2, 1895.

Yours truly, JOSEPH L. HILLS,

(Director of the Vermont Experiment Station.)

Dr. Babcock's Report.

Your No. 1 B Separator has done most excellent work in every trial which we have made with it. It skims 2,000 pounds per hour on the average, and the skim milk usually contains about one-tenth of one per cent. This is a most excellent showing.

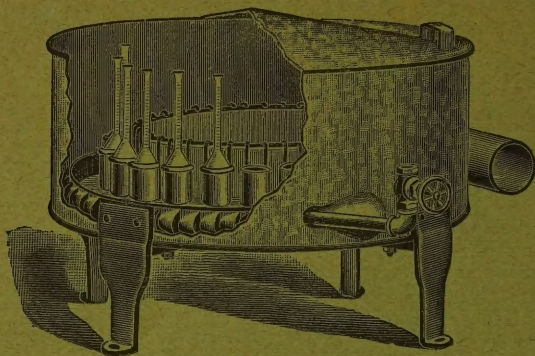
I think for the amount of work which the machine does that the power is very low.

Madison, Wis., April 7, 1894.

S. M. BABCOCK,

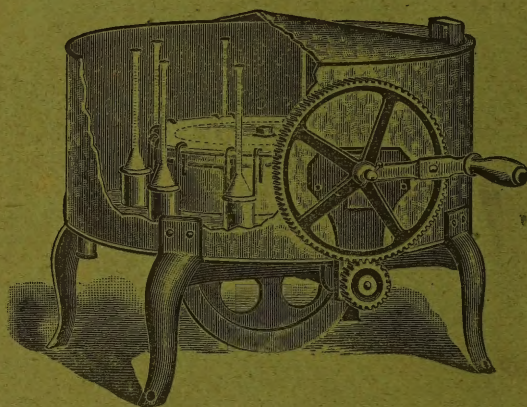
Chief Chemist Agricultural Experiment Station,
University of Wisconsin.

Dr. Babcock writes us that he never reads any test closer than one tenth of one per cent when testing by Babcock Test; this shows that by the above record the U. S. Separator leaves in the smallest amount of fat possible.



JAS. R. CONKLIN,
MORAVIA, N. Y.

V. F. M.
STEAM MOTOR BABCOCK TESTER.



V. F. M.
HAND OPERATED BABCOCK TESTER.